

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B06B1/02 G 1/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B06B H04R G01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 012, no. 177 (E-613), 25 May 1988 (1988-05-25) & JP 62 284600 A (AGENCY OF IND SCIENCE & TECHNOL), 10 December 1987 (1987-12-10) abstract	1-5, 15, 17-19, 22, 33-35
X	PATENT ABSTRACTS OF JAPAN vol. 011, no. 061 (E-483), 25 February 1987 (1987-02-25) & JP 61 220600 A (NEC CORP), 30 September 1986 (1986-09-30) abstract	1, 3, 15
A	US 5 335 210 A (BERNSTEIN JONATHAN) 2 August 1994 (1994-08-02) column 5, line 1 - line 7 -/-	3, 4, 32, 33, 35

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

9 November 1999

Date of mailing of the international search report

24/11/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Häusser, T

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>PEDERSEN M ET AL: "A silicon condenser microphone with polyimide diaphragm and backplate" SENSORS AND ACTUATORS A, vol. 63, no. 2, 30 October 1997 (1997-10-30), page 97-104 XP004125898 ISSN: 0924-4247 page 100, right-hand column -page 101, left-hand column; figure 6</p>	23,24,27
A	<p>SCHEEPER P R ET AL: "FABRICATION OF SILICON CONDENSER MICROPHONES USING SINGLE WAFER TECHNOLOGY" JOURNAL OF MICROELECTROMECHANICAL SYSTEMS, vol. 1, no. 3, 1 September 1992 (1992-09-01), pages 147-154, XP000358599 ISSN: 1057-7157 page 148; figure 1</p>	9-11, 23-27
A	<p>THIELEMANN C ET AL: "Capacitive silicon sensors for ultrasound" ACUSTICA - ACTA ACUSTICA, JULY-AUG. 1997, S. HIRZEL VERLAG, GERMANY, vol. 83, no. 4, pages 715-720, XP002121908 ISSN: 0001-7884 page 719, right-hand column; figure 8</p>	23,24,27
A	<p>MATTILA P ET AL: "BANDWIDTH CONTROL OF AN ELECTROSTATIC ULTRASONIC TRANSDUCER" SENSORS AND ACTUATORS A, vol. A45, no. 3, 1 December 1994 (1994-12-01), pages 203-208, XP000482630 ISSN: 0924-4247 abstract</p>	13,20,30

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference JL2183	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/GB 99/ 02217	International filing date (<i>day/month/year</i>) 23/07/1999	(Earliest) Priority Date (<i>day/month/year</i>) 23/07/1998
Applicant THE SECRETARY OF STATE FOR DEFENCE et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.
☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☐ the text is approved as submitted by the applicant.

☒ the text has been established by this Authority to read as follows:

METHOD OF MANUFACTURING A CAPACITIVE ULTRASOUND TRANSDUCER

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1
☐ None of the figures.

INTERNATIONAL SEARCH REPORT

national Application No

T/GB 99/02217

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B06B1/02 G01H11/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

9 November 1999

Date of mailing of the international search report

24/11/1999

Name and mailing address of the ISA

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Fax: (+31-70) 340-3016

Authorized officer

Häusser, T

INTERNATIONAL SEARCH REPORT

International Application No.

T/GB 99/02217

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	<p>THIELEMANN C ET AL: "Capacitive silicon sensors for ultrasound"</p> <p>ACUSTICA - ACTA ACUSTICA, JULY-AUG. 1997, S. HIRZEL VERLAG, GERMANY, vol. 83, no. 4, pages 715-720, XP002121908 ISSN: 0001-7884 page 719, right-hand column; figure 8</p> <p>---</p>	23,24,27
A	<p>MATTILA P ET AL: "BANDWIDTH CONTROL OF AN ELECTROSTATIC ULTRASONIC TRANSDUCER"</p> <p>SENSORS AND ACTUATORS A, vol. A45, no. 3, 1 December 1994 (1994-12-01), pages 203-208, XP000482630 ISSN: 0924-4247 abstract</p> <p>-----</p>	13,20,30

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

/GB 99/02217

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 62284600 A	10-12-1987	JP 1956651 C JP 4076560 B	10-08-1995 03-12-1992
JP 61220600 A	30-09-1986	NONE	
US 5335210 A	02-08-1994	NONE	

PATENT COOPERATION TREATY

PCT

REC'D 16 OCT 2000

WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



Applicant's or agent's file reference JL2183		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB99/02217	International filing date (day/month/year) 23/07/1999	Priority date (day/month/year) 23/07/1998	
International Patent Classification (IPC) or national classification and IPC B06B1/02			
Applicant THE SECRETARY OF STATE FOR DEFENCE et al.			

- This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 7 sheets, including this cover sheet.
 - ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 10 sheets.

- This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 21/02/2000	Date of completion of this report 12.10.2000
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Tasiaux, B  Telephone No. +49 89 2399 2555

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB99/02217

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1,4,6-9,12-21	as originally filed		
2,3,3a,5,10,11	as received on	13/07/2000 with letter of	13/07/2000

Claims, No.:

25-35	as originally filed		
1-24	as received on	13/07/2000 with letter of	13/07/2000

Drawings, sheets:

1/3-3/3	as originally filed
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2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB99/02217

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-24
	No:	Claims	
Inventive step (IS)	Yes:	Claims	9-10,19
	No:	Claims	remaining claims
Industrial applicability (IA)	Yes:	Claims	1-24
	No:	Claims	

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. The preliminary examination is based on following documents (D) cited in the International Search Report. The following numbering will be adhered to :

D1 = JP-A- 62 284 600 (and more particularly the abstract thereof)

D2 = JP-A- 61 220 600 (and more particularly the abstract thereof)

2.

- 2.1 From Document D1 is known an ultrasound apparatus showing, on a common silicon substrate, a plurality of cavities built by recesses 12 in the substrate and covered by a movable polymer membrane 84 attached to it, with respective electrodes 6, 49 in resp. the cavities and on the membrane. A reading/driving electronic circuitry 8 is provided as well in the substrate.
- 2.2 It is noted that each respective cavity known from D1 has, considered alone, exactly the same features as the cavity claimed in the present application.
- 2.3 It therefore appears that the sole difference between the subject-matter of the present application and the one of D1 is that, according to the present application, there is a single cavity in the substrate.

In other words, it is equivalent to an array of one element.

- 2.4 This single difference does not involve any inventive activity.

The number of cavities to be formed on the substrate is a matter of design depending on the circumstances. In particular, if a single cavity can do the job, there is no reason to form more cavities on the substrate and this is obvious to the skilled person.

Since each respective cavity from the prior art has the same features as the cavity claimed in the present application, it will work equally well, in particular, if there is a

single such cavity on the substrate.

Indeed, the claimed cavity has no peculiar feature that would generate any surprising effect or make it remarkable with respect to the cavities known from the prior art.

2.5 A similar analysis can be made from D2, see the unique figure of the abstract.

3. With the exception of Claims 9-10, the dependent claims merely suggest slight constructional changes of the device which come within the scope of the customary practice followed by persons skilled in the art, especially as the advantages thus achieved can be readily contemplated in advance.

None of these claims can serve as a basis for an allowable independent claim.

4. The same remarks apply to the other apparatus and method claims.

5. However, the subject-matter defined by the combination of Claims 1 and 9-10 is neither disclosed nor suggested by the cited prior art documents.

Indeed, none of the documents cited in the International Search Report discloses a transducer made of a hole-free membrane bond to a substrate and defining a cavity therebetween in which the membrane forms a bump over the substrate. Furthermore, this device involves an inventive step, since, although transducers with a curved membrane bond to a substrate are known in the art, see by example US-A- 5 335 210, these known curved membranes are designed with holes and do not therefore define a closed cavity in the sense of D1, i.e. a cavity isolated from the external medium. The novel design proposed by combination of Claims 1 and 9-10 (see also the remarks under VIII.3) much simplifies the processing of the substrate. Claim 1 meets therefore the requirements of Art. 33(2), 33(3) PCT.

Re Item VII

Certain defects in the international application

1. To meet the requirements of Rule 6.3(b) PCT, the independent claims should be properly cast in the two part form, with all those features which in combination are

part of the prior art (see document **D1**) being placed in the preamble.

2. *It should be made clear in the description (and the drawings) that the embodiment of Fig. 6 is known from the prior art. This will require extensive review of the actual description and/or removal from the corresponding parts (e.g. pg. 17, l.6-7).*
3. Reference signs should be put *between parentheses*.
4. If new claims are filed during the regional phase, the description will have to be brought into conformity with the new claims to be filed. Care should be taken during revision, especially of the introductory portion including any statements of problem or advantage, not to add subject-matter which extends beyond the content of the application as originally filed, Article 34(2)(b) PCT.

In order to avoid further objections concerning Article 34(2)(b) PCT and to expedite the procedure in the regional phase, detailed indications concerning the locations where the features of each new claim had originally been disclosed should be supplied.

5. The numerical values expressed in Angstrom at various places in the description (e.g. pg. 14 and 16) do not meet the requirements of Rule 10.1(a) PCT and should be replaced by the appropriate values in SI units. The present expressions should, however, be retained in parentheses after the replacement expressions.

Re Item VIII

Certain observations on the international application

1. The independent claim claiming an array of transducer, each having a single cavity, should be defined is reference to the claims claiming the latter.
2. Claim 22 is contradictory : whilst it appears that the apparatus claims require that there is only one cavity per substrate defining thereby a transducer, Claim 22 appears to require that all transducers are formed on the same substrate which is in contradiction with the definition of a transducer provided by the apparatus claims.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB99/02217

Moreover, if this was actually so, the subject-matter of Claim 22 would be anticipated by both D1 and D2 showing arrays of transducers sharing the same substrate.

3. The combination of Claims 1 and 9-10 should make clear that the membrane has no holes, so as to define a cavity hermetically sealed from the external medium (thereby still enabling the embodiment of Fig. 3 but distinguishing itself from US-A- 5 335 210 or the like), and should precisely identify where the electrodes are located (i.e. one inside, the other outside the cavity).

17-14

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C.20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 10 March 2000 (10.03.00)	
International application No. PCT/GB99/02217	Applicant's or agent's file reference JL2183
International filing date (day/month/year) 23 July 1999 (23.07.99)	Priority date (day/month/year) 23 July 1998 (23.07.98)
Applicant NOBLE, Russell et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
21 February 2000 (21.02.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Authorized officer

S. Mafla